THERMO-OPTICAL PROPERTIES OF LUNAR DUST SIMULANTS. A. A. Zinecker[1] and B. H. Spivey[2], [1]NASA Johnson Space Center (2101 E NASA Pkwy, Houston, TX 77058, abigail.a.zinecker@nasa.gov), [2]Jacobs (2224 Bay Area Blvd, Houston, TX 77058, brittany.h.spivey@nasa.gov).

Introduction: Lunar dust coverage can significantly impact the thermo-optical properties of external surfaces for spacecraft and systems operating in the Lunar orbit or on the Lunar surface. This impacts the thermal control of these vehicles. Testing must be done to determine how much surface optics are affected by varying levels of lunar dust coverage. Optics and Particle Size Distributions (PSDs) of the dust simulant used in these tests are critical to the results. Many lunar dust simulants are available for testing, but their thermo-optical properties are not well characterized. To resolve this unknown, 13 different lunar dust simulants' IR emissivity and solar absorptivity were measured and are presented with their PSDs here.

Simulants: The simulants analyzed in this study are listed in Table 1 below and were chosen to represent both Mare and Highlands samples.

Table 1- Simulants chosen for optical property measurements.

Number	Simulant
1	Exolith LHS 1
2	Exolith LSM 1
3	JSC 1A
4	NU LHT 2M
5	NU LHT 4M
6	OPR4W30
7	OPRH3N
8	OPRH3W20
9	OPRH3W25
10	OPRH3W30
11	OPRH3W35
12	OPRL2N
13	NULHR Agglutinates*

Optics Measurement Methodology: Simulants were prepared by dispersing the dust in isopropyl alcohol and then dissolved in order to achieve a loose packed particle bed in specially 3D printed sample containers. Samples were placed on a hot plate to remove the moisture resulting in a flat, uniform thickness surface. Each container was sealed with optically transparent low density polyethylene before being placed in the spectrometers to measure solar and IR transmittance and reflectance, as shown in Figure 1. Solar optics were measured in a Perkin Elmer Lambda 950 Spectrometer with a 150 mm integrating sphere and IR optics were measured with a Thermo Scientific Nicolet iS50 with a midIntegrat Sphere from Pike Technologies. Reflectivity and transmissivity data were post-processed using the AM0 solar spectrum to return solar absorptivity [1].

Figure 1- One of the dust simulants inside the 3D-printed sample container mounted inside the Lambda 950 Spectrometer.

Future Work: Next steps for this team are performing dust coverage testing on different surface materials to evaluate change in surface thermo-optical properties and therefore heat rejection capability. The team also plans to use this data to predict worst-case optics of surfaces analytically and validate with test data.

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References:

[1] ASTM, Standard Extraterrestrial Reference Spectrum, ASTM E490-00a, 2019.